CLAIMS

1. Substantially pure chromium dioxide (CrO_2) having saturation magnetization of at least 110 emu/gm.

2. Chromium dioxide according to claim 1 having saturation magnetization of at least 120 emu/gm.

3. Chromium dioxide according to claim 2 having saturation magnetization of 126 emu/gm for sintered pellets.

4. Chromium dioxide according to claim 2 having saturation magnetization of 132 to 135 emu/gm for cold pressed form.

5. Chromium dioxide according to claim 1, which is in polycrystalline form.

6. Chromium dioxide according to claim 1 having negative magnetoresistance of at least 0.5% near room temperature at 2 Tesla

7. Chromium dioxide according to claim 6 having negative magnetoresistance of at least 2% near room temperature at 2 Tesla.

8. Chromium dioxide according to claim 7 having negative magnetoresistance of about 5% near room temperature at 2 Tesla.

9. Composites of chromium dioxide and chromium sesquioxide (CrO_2/Cr_2O_3) having negative magnetoresistance of atleast 0.5% near room temperature at 2 Tesla.

10 Composites according to claim 9, having negative magnetoresistance of atleast 2% near room temperature at 2 Tesla

composites of CrO_2/Cr_2O_5 wherein a single tunable experimental parameter is needed to obtain (a), (b) and (c).

Summary of the invention:

According to the present invention there is provided substantially pure chromium dioxide (CrO_2) having saturation magnetization of at least 110 emu/gm.

The present invention also provides composites of chromium dioxide and chromium sesquioxide (CrO_2/Cr_2O_3) having negative magnetoresistance of at least 0.5% near room temperature at 2 Tesla.

The present invention also provides composites of chromium dioxide and Cr_2O_5 (CrO_2/Cr_2O_5) having enhanced negative magnetoresistance of at least 0.5% near room temperature at 2 Tesla.

The present invention further provides a process for manufacture of half metallic ferromagnet, substantially pure chromium dioxide (CrO_2), or composites of chromium dioxide and chromium sesquioxide (CrO_2/Cr_2O_3) or composites of chromium dioxide and Cr_2O_5 (CrO_2/Cr_2O_5) comprising heating an intermediate oxide of chromium to a temperature of between 350 and 500°C for a period of between 1-5 hours whereby substantially pure chromium dioxide (CrO_2), or composites of chromium dioxide and chromium sesquioxide (CrO_2/Cr_2O_3) or composites of chromium dioxide and Cr_2O_5 (CrO_2/Cr_2O_5) are formed.

Detailed description of the invention

Half metallic ferromagnet, substantially pure chromium dioxide (CrO_2) according to the present invention exhibits saturation magnetization (M_S) of at least 110 emu/gm Preferably the M_S value is atleast 120 emu/gm and most preferably 135 emu/gm for cold pressed sample of CrO_2 and 126 emu/g for sintered pellets. As a consequence of such high purity of the sample, there is evidence of maintained spin polarization near room temperature and the chromium dioxide of the present invention exhibits negative magnetoresistance of atleast 0.5% near room temperature at 2 Tesla, preferably 2% and most preferably 5 % MR at room temperature at 2 Tesla for sintered pellet of pure CrO_2

Composites of chromium dioxide and chromium sesquioxide (CrO_2/Cr_2O_3) according to the present invention have enhanced negative magnetoresistance of atleast

assemblies leading to high production cost are the main drawbacks of above-mentioned preparative methods. It is desirable to have a preparative method, which does not need pressure as controlling parameter.

(d) The last three US patents in the above table form relevant prior art to the present invention and will be discussed after describing the present invention in detail.

A ferromagnetic sample is characterized by its saturation magnetization M_s at 0 K and Curie temperature T_c. The theoretical value for saturation magnetization for CrO_2 is about 135 emu/gm. The best-reported value for the saturation magnetization for polycrystalline samples range from 75 –87 emu/gm as reported in earlier patents (Table 2). The single crystals have shown value of the order of 108 emu/gm. The best values of Ms for polycrystalline CrO_2 supplied by DuPont is from 87-110 emu/g as given in " Spin phonon coupling in rod shaped half metallic CrO_2 ultra fine particles: a magnetic Raman scattering study, T Yu et al., J. Phys. Condens. Matter **15**, L213, 2003 and "Junction like magnetoresistance of intergranular tunneling in field aligned chromium dioxide powders", Jianbiai Dai and Jinke Tang, Phy. Rev. B, 63, 054434 (2001).

Since the saturation magnetization value (M_s) is an important criterion for a pure ferromagnetic material, and is a test for comparing various processes, some M_s values from literature for CrO_2 are given in Table 2.